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CHERSKOV & FLAYNIK		EXAMINER		
The Civic Opera Building		SKOWRONEK, KARLHEINZ R		
Suite 1447				
20 North Wacker Drive		ART UNIT PAPER NUMBER		
Chicago, IL 60606		1631		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/823,509	Applicant(s) RAJH ET AL.	
	Examiner Karlheinz R. Skowronek	Art Unit 1631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 September 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 28-40 is/are pending in the application.
- 4a) Of the above claim(s) 1, 37-40 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 28-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

The examiner of record has changed. Please direct all further correspondence to Karlheinz R. Skowronek whose telephone number is (571) 272-9047.

Election/Restrictions

Applicant's election with traverse of group II (claim 28-36, 38, and 40) and Species A relating to a biological material: Nucleotides; Species B relating form and source of radiation: white light radiation and laser source; Species C relating to a metal oxide: TiO_2 , in the replies filed on 10 September 2007, 18 May 2007, and 28 November 2006 are acknowledged. The traversal is on the ground(s) that an election of species from a Markush claim is improper. This is not found persuasive because restriction of Markush groups recited within claims is proper (see MPEP 803.2). However, the MPEP in 803.2 does also indicate that it would be improper for the office to refuse to examine that which applicant regards as their invention, unless the subject matter in the claim lacks unity of invention (emphasis added). The MPEP further states in 803.2 that unity of invention exists where compounds share a common utility and share a substantial structural feature essential to the utility (emphasis added). In the instant case, species A as identified in the restriction dated 12 October 2006 is directed to the Markush group of claim 29 and contains the members of nucleotides, nitrogenous heterocyclic bases, amino acids and combinations. In applying the test for lack of utility set forth in MPEP 803.2, nucleotides do not share a common utility with amino acids, nucleotides having the common utility as carriers of information in polymer form. Further, amino acids do

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not share a substantial structural feature with nucleotides, nucleotides having a ribose core which is not present in amino acids. Thus unity is lacking in the members of the Markush group of claim 29 and species A. Therefore, restriction between the members of the Markush is proper. With regard to species B a similar argument that the members of the group lack unity of invention. The each of the members of species B has distinct spectral features that are tied to their distinct individual utilities and are therefore mutually exclusive. Thus the members of species B lack unity of invention. With regards to the members of species C, the members share a common utility of being semiconductors. However, the members of the group do not share a common structural feature that is essential for the utility because each of the metals has a distinct atomic structure that distinguishes the individual metals. Therefore, restriction requirement of species C is proper.

Claims 1, and 37-40 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected group and species, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 28 November 2006.

The requirement is still deemed proper and is therefore made FINAL.

Claim Status

Claims 1 and 28-40 are pending.

Claims 2-27 are cancelled.

Claims 1 and 37-40 stand withdrawn as being directed to a non-elected invention and species.

Claims 28-36 are being examined.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 28-33 and 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Empedocles et al. (US PG PUB 20030099940), in view of Chan et al. (Science, Vol. 281, p2016-2018, 1998), and Wamer et al. (Free Radical Biology and Medicine, Vol. 23, No. 6, p, 851-858, 1997).

The claim is directed to a method of manipulating biological material in vivo by introducing a semiconductor-complexed biological moiety into a living organism and causing a structural change in the biological material. In an embodiment, the biological material is nucleotides. In an embodiment, charges are created by radiation.

Empedocles et al. shows a method of attaching a semiconductor, also referred to as a quantum dot [0061], to a biological moiety [0111]. Empedocles et al. defines the term affinity moiety as a biological moiety [0045-0046]. Empedocles et al. shows the affinity moiety is attached to the semiconductor nanocrystal [0119]. Empedocles shows an embodiment in which the semiconductor is attached to affinity molecules that are polynucleotides [0174].

Empedocles et al. does not show that bioconjugated semiconductor particle is introduced into a living organism and does not show that by irradiating the semiconductor particle bioconjugate the biological material is changed.

Chan et al. shows that Quantum dots can be introduced into living organisms (p. 201, col. 3). Chan et al. shows bioconjugated quantum dot migrates to a target biological material within a cell (figure 4). Chan shows that quantum dots have an advantage over conventional fluorophores of an improved photostability (p. 2018, col. 2).

Wamer et al. shows that by irradiating TiO_2 with 400nm light structural changes in DNA can be obtained. Wamer et al. shows that nucleic acid is photo-oxidized in the presence of light-activated TiO_2 (p. 855, col. 1-2). Wamer et al. shows an embodiment in which 400 nm visible violet light, reading on white light (visible light) (p. 852, col. 2). Wamer et al. shows an embodiment in which charges are created by radiation (p. 851, col. 1). Wamer et al. shows an embodiment in which the radiation has energy greater than 1.6 eV (p. 851, col. 1). Wamer et al. shows a plurality of charges is generated using light to the induced structural changes in nucleic acid as oxidative damage (p. 856, col. 2). Wamer suggest that TiO_2 should be adsorbed to DNA, that is a bioconjugate formed between TiO_2 and DNA (p. 857, col. 1). Wamer et al. suggests that TiO_2 may be a useful photodynamic therapy of cancer (p. 851, col. 2). Wamer et al. shows that irradiated TiO_2 is a catalyst for a variety of redox reactions that include decarboxylation of carboxylic acids and hydrogen production from carbohydrates and water. Wamer et al. shows that TiO_2 provides the advantage of possessing antibacterial activity when irradiated (p. 851, col. 2).

It would have been obvious to one skilled in the art to modify the method of attaching a semiconductor particle to a biological molecule of Empedocles et al. with the

method of introducing bioconjugated quantum dot into cells of Chan et al. and the method of inducing structural changes in biological material by generating a plurality of charges of Wamer et al. because Chan et al. show quantum dots provide an improved photostability. It would have been further obvious to modify the method of attaching a semiconductor particle to a biological molecule of Empedocles et al. with the method of introducing bioconjugated quantum dot into cells of Chan et al. and the method of inducing structural changes in biological material by generating a plurality of charges of Wamer et al. because Wamer et al. shows that the semiconductor particle, TiO_2 has photodependent cytotoxic activity that is capable of damaging biological material that gives it antibacterial activity.

Claims 28 and 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Empedocles et al., in view of Chan et al., and Wamer et al. as applied to claim 28-33 and 36 above, and further in view of Knowland et al. (WO 99/60994).

Claim 34 is directed to change in nucleic acid structure that is cleavage. In an embodiment, the semiconductor accumulates electron from a first biological moiety.

Empedocles et al., in view of Chan et al., and Wamer et al. as applied to claim 28-33 and 36 above teach a method for manipulating a biological material in vivo.

Empedocles et al., in view of Chan et al., and Wamer et al. as applied to claim 28-33 and 36 above do not teach DNA cleavage.

Knowland et al. shows that light irradiated TiO_2 induce strand breakage reading cleavage (figure 4). Knowland et al. shows that TiO_2 induces double strand cleavage at

guanine residues in DNA (p. 14). Knowland et al. shows an embodiment that the semiconductor accumulates electrons from the molecule to which it is adsorbed (p. 2).

It would have been obvious to modify the method for manipulating a biological material in vivo of Empedocles et al., in view of Chan et al., and Wamer et al. as applied to claim 28-33 and 36 above with the TiO_2 catalyzed light DNA strand breakage of Knowland et al. because Knowland shows that in addition to inducing double strand breakage in DNA, light activated TiO_2 DNA manipulation is not confined to double strand breaks and can generate other types of lesions in DNA.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karlheinz R. Skowronek whose telephone number is (571) 272-9047. The examiner can normally be reached on Mon-Fri 8:00am-5:00pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marjorie A. Moran can be reached on (571) 272-0720. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

19 November 2007

/KRS/
Karlheinz R. Skowronek
Assistant Examiner, Art Unit 1631

/John S. Brusca/
Primary Examiner
Art Unit 1631